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REMARKS

Claims 3-16, 20-23 and 26-29 were addressed in the office action. Claims 14-16, 20-23 and 26-29 have been withdrawn from consideration as nonelected claims. Claims 3-12 stand rejected. (The inclusion in the subject office action of claim 13 among the rejected claims is taken to be inadvertent, as claim 13 is a non-elected claim. Claim 13 is therefore treated herein as having been withdrawn from consideration). Claim 3 is amended in a non-limiting manner to more clearly define the claimed subject matter.

A. Request for Reconsideration of Restriction Requirement

In the subject office action, the Examiner has maintained the restriction requirement and made it final on the grounds that "[I]nvention I (claims 3-12) and III (claims 21-23 and 26-28) are distinct because the process (III) can be used to make a detonating cord with a granular core whereas the detonating cord of claim 3 requires a solid core." The stated rationale, however, is based on a misunderstanding of the claims. The core of the detonating cord of claim 3 expressly comprises a pulverulent explosive and the method of claim 21 address the use of a pulverulent explosive; such an explosive is inherently solid (as opposed to being liquid; liquids cannot be pulverulent) as recited in claim 3. Therefore, the requirement in claim 3 for a solid core did not provide a distinction from claim 21 adequate to sustain the asserted grounds for restriction. In any event, the word "solid" is now removed from claim 3, since it was not needed. To illustrate that these claims are not patentably distinguishable, they are set forth side-by-side in the following table:

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<p>3. A detonating cord comprising</p> <p>(i) an elongate tubular sheath encasing a core of</p> <p>(ii) an explosive material comprising a first pulverulent explosive admixed with a diluent comprising explosively inert microballoons</p> <p>in an amount which reduces the velocity of detonation of the detonating cord as compared to that of an otherwise identical detonating cord in which the explosive material contains no explosively inert microballoons</p>	<p>21. A method for making a detonating cord comprises the steps of</p> <p>(i) preparing</p> <p>an explosive material by admixing a first pulverulent explosive with a diluent comprising explosively inert microballoons</p> <p>in an amount which reduces the velocity of detonation of the detonating cord as compared to an otherwise identical detonating cord in which the explosive material contains no diluent; and</p> <p>(ii) enclosing the explosive material within a tubular sheath to provide a detonating cord having a core of the explosive material.</p>
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As is evident from the comparison above, claim 3 and claim 21 are not patentably distinguishable from each other, since limitation 3(ii) so closely tracks limitation 21(i) and limitation 3(i) corresponds to limitation 21(ii), and there is no evidence of how the process of claim 21 can result in a materially different product than is defined in claim 3, or how the product of claim 3 could be made by a process that is materially different from that of claim 21. Therefore, the requirement for election between them cannot properly be maintained. Furthermore, since the product and method of making are not patentably distinct, the method of use (invention II; claims 13-16, 20 and 29) must be joined as well. See 37 CFR 1.141(b); MPEP 806.05(i). Rejoinder of the non-elected claims is therefore respectfully requested.

B. Preliminary Remarks – Reply to Response to Arguments

The stated grounds of rejection of the Applicant's claims and the Examiner's "Response to Arguments" indicate that the Examiner has overlooked salient aspects of the Applicants' disclosure and has misinterpreted certain cited references. For example, the Examiner asserts that the Applicant has failed to provide evidence of the unexpected results they allege, and that there is "no showing to indicate how (Hales et al.'s results) differs from the result

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that is obtained by the Applicant.” However, as discussed more fully below, evidence of the unexpected results is provided in the specification at paragraphs [0052] and [0053], and the Applicant’s results show the *opposite* of what the Hales et al. reference shows.

Similarly, as discussed further below, one of the grounds for rejecting the claims is based on the teaching of a secondary reference (Driscoll) concerning the affect of microballoons on the sensitivity of an explosive material, whereas the reference provides no such teaching and is not properly combinable with the cited primary reference (Jones).

The Examiner also states that the claims are inadequate to overcome the cited references because “it seems clear that the results would not occur with any amount of the diluent and since no amounts are claimed in the independent claim, it is not clear how these alleged unexpected results could occur.” On this point, the Examiner is reminded that the claims recite the presence of microballoons and their desired effect, and that such functional limitations are perfectly valid and must be considered (see MPEP 2173.05(g), 8th Ed. Rev. May 2004). Therefore, the question of whether there are amounts of microballoons that do not yield the desired effect is not relevant because no such embodiments fall within the scope of claim 3. Applicants are not obliged to include in the claim the numerical quantity for the component that provides the stated function. See Andrew Corp. v. Gabriel Electronics, 6 USPQ2d 2010 (Fed. Cir.1988) (overturning Brown Bridge et al. v. Sales Affiliates, 700 F.2d 759, 217 USPQ2d 651 (1st Cir.1983)) (“A claim is not fatally defective for failing to specifically delineate the point at which the change in physical phenomenon occurs.” Andrew Corp. at 2014.).

C. Rejection of Claims 8 and 9 Under 35 U.S.C. §112

Claims 8 and 9 have been amended in a non-limiting manner to address the ground of rejection set forth under §112. Support for the presence of a second explosive material less brisant than the principal explosive ingredient (an “explosive diluent”) is found in the specification as filed at paragraph [0050].

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D. Rejection of Claims 3, 5, 8 and 10-12 Under 35 U.S.C. §103

Claims 3, 5, 8 and 10-12 stand rejected under 35 U.S.C. §103 as being obvious over U.S. Patent 3,789,759 to Jones (the Jones reference) in view of U.S. Patent 5,880,399 to Hales et al. (the Hales et al. reference). The Jones reference discloses a detonating cord comprising an explosive core that may include various non-explosive diluents and inerts, but fails to disclose microballoons as a diluent.

Claim 3, from which all of the above-mentioned claims depend, defines a detonating cord comprising an elongate tubular sheath encasing a core of an explosive material. The explosive material comprises a first pulverulent explosive admixed with explosively inert microballoons in an amount which reduces the velocity of detonation of the detonating cord as compared to that of an otherwise identical detonating cord without such microballoons. Claim 10 had been amended to be in independent form, but also defines a detonating cord having a core of explosive material that contains a diluent comprising microballoons. Explicit evidence of the velocity-reducing effect of the microballoons is provided in Tables 1 and 2 of paragraphs [0052] and [0053] of the application as filed.

The Examiner alleges that the velocity-diminishing effect of microballoons is shown in the Hales et al. reference. However, the Examiner only cites disclosures therein at column 2, lines 10-45 addressing the effect of microballoons on impact and initiation sensitivities, run-up distance and critical diameter, all of which relate to cast boosters and none of which are detonation velocities. More significantly, when the Hales et al. reference addresses detonation velocity at column 4, lines 55-58, it states that microballoons *increase* detonation velocity in the booster charge. *This teaching is the opposite of what the Applicants disclose they found regarding the effect of microballoons on detonation velocity.* Therefore, even if the Hales et al. reference purported to be relevant to detonating cord, the data reported by the Applicants would clearly establish unexpected results that would overcome a prima facie obviousness-type rejection based on the combined disclosures of Hales et al. reference and the Jones reference.

Furthermore, the Applicants respectfully maintain that the Jones reference and the Hales et al. reference cannot properly be combined to support a rejection under 35 U.S.C. 103 because the references disclose devices that comprise different physical forms of explosive

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materials, and it is known in the art that the form of an explosive material affects its detonation characteristics. The differences between the explosive materials in the cited references are evident from their modes of manufacture and use. The Hales et al. reference shows the use of microballoons in a solid cast booster, which is cast from molten or curable material into a relatively short solid block, whereas the Jones reference discloses a detonating cord, for which the explosive material must be disposed in an elongated, flexible configuration to allow the user to dispose it in various configurations, to tie it in knots, etc. (see the Jones reference at, e.g., column 4, lines 19-24). In view of these differences, a detonating cord would be expected to have significantly different properties and to perform different functions from those of cast boosters, and it would not be obvious that microballoons would function in detonating cord of the Jones reference in the same way they function in the cast booster of the Hales et al. reference. Therefore, there seems to be no basis in the art for combining the cited teachings of these references, or for reasonably expecting that the results reported in one of them would also be attained in the other, and the suggestion to do so and expectation that the same results would be obtained appears to be the result of improper hindsight reasoning. Accordingly, claims 3 and 10 and the claims dependent therefrom are patentable over the prior art, and the stated ground of rejection is respectfully traversed.

12. Rejections of Claims 4, 6, and 7 Under 35 U.S.C. §103

Claims 4, 6, and 7, which specify microballoons of a specific size, stand rejected under 35 U.S.C. §103 as being unpatentable over the Jones reference in view of the Hales et al. reference and further in view of U.S. Patent 4,547,234 to Takeuchi et al. The Takeuchi et al. reference is cited for disclosing the phenolic resin microspheres (microballoons) of the claimed size.

The identified claims are all patentable at least because they depend from a base claim that is patentable for reasons set forth above in section D of this response.

Further, the Takeuchi et al. reference discloses that when the specifically sized microballoons are combined with an explosive, they provide a low detonation temperature over a long storage period (see column 3, lines 5-15), thus indicating enhanced sensitivity. However, the Takeuchi et al. reference also teaches that lowering the sensitivity and/or detonation

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velocity of the explosive material is to be avoided (see column 4, lines 20-48), whereas the Hales et al. reference states a preference for reducing the sensitivity of a cast booster (see column 2, lines 5-10). The references therefore provide no motive for making use of the microballoons disclosed by the Takeuchi et al. according to disclosure of the Hales et al. reference, as the Examiner proposes, and in fact teach away from such a combination. Since the combined teachings of the art militate away from these claims, they should be viewed as presenting an additional basis of patentability independent of the patentability of claim 3. For the foregoing reasons, the stated ground of rejection is respectfully traversed.

F. Rejections of Claim 9 Under 35 U.S.C. §103

Claim 9 stands rejected under 35 U.S.C. §103 as being obvious on various different grounds: (i) over the Jones reference in view of the Hales et al. reference (sections 9 and 10 of the office action), and (ii) over the Jones reference, U.S. Patent 3,683,811 to Driscoll (the "Driscoll reference") and further in view of the Driscoll reference in view of U.S. Patent 3,367,266 to Griffith (section 13 of the office action). It is noted that in section 9 of the office action, the Examiner first cites Jones, but then refers to a passage in Griffin.

Claim 9 is allowable at least because it depends from a base claim that is allowable for reasons set forth herein.

G. Rejection of Claims 3, 5, 8, and 10-12 Under 35 U.S.C. §103

The captioned claims stand rejected under 35 U.S.C. §103 as being unpatentable over the Jones reference in view of the Driscoll reference. The Jones reference is cited for disclosing detonating cord that may contain a high explosive material and an unspecified diluent, whereas the Driscoll reference is cited for disclosing phenolic microballoons as an inert diluent.

The basis of the rejection, as stated in the "Response to Arguments," is that the Driscoll reference "clearly teaches the use of microballoons to decrease the burn rate, which makes the composition less sensitive...." and that Driscoll reference discloses results "that are exactly what the Applicant is claiming is unexpected." In section 11, at the top of page 6 of the office action, the Examiner asserts that "Driscoll teaches that microballoons make the ex-

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plosive less sensitive" and that it would be obvious "to use the microballoons taught by Driscoll in place of the inert diluents present in Jones."

The Applicants respectfully submit that the Examiner has misinterpreted the Driscoll reference, and so based the foregoing rejection on faulty grounds. Contrary to the Examiner's assertion, the Driscoll reference provides no teaching whatever concerning the effect of microballoons on explosive materials, since the microballoons were not included in the explosive material in Driscoll's device. Rather, Driscoll discloses that microballoons slow a burning reaction in the ignition composition, without any indication of how slowing the rate of a burning reaction can be equated to reducing the sensitivity of an explosive material. Thus, there appears to be no support for the Examiner's assertion that Driscoll teaches that microballoons "make the explosive less sensitive". Furthermore, the references provide no motive for reducing the sensitivity of the Jones detonating cord. Therefore, the cited references provide no suggestion to add microballoons to the explosive material in a detonating cord.

In addition, the art provides no motive for adding the microballoons of the Driscoll reference to the explosive core of the detonating cord of the Jones reference, because the benefit provided by microballoons in the Driscoll reference has no relevance to the Jones reference. The Driscoll reference addresses the electrical continuity characteristics ("reform time") in a bridgewire igniter, but there is no electrical bridgewire in the Jones reference detonating cord, so reform time is not an issue. Nor is any other motive evident for wanting to reduce the velocity of the reaction in the Jones detonating cord, even if the microballoons disclosed by the Driscoll reference were taught to be effective for this purpose. Therefore, the art fails to provide a motive for making the proposed combination of the microballoons of the Driscoll reference with the detonating cord of the Jones patent.

In any case, the disclosure of the Driscoll reference is not combinable with the disclosure of the Jones reference, because detonating cord (the Jones reference) does not function by virtue of a burning reaction; it detonates. As shown by the evidence submitted by the Applicants with the response dated May 19, 2004 (the pages from Explosives, 2d Ed., by Rudolf Meyer (Verlag Chemie 1981)) the art recognizes a clear distinction between burning (deflagration) reactions and detonation reactions. Therefore, those in the art would not assume that all measures effective for slowing of a burning reaction would also slow the rate of a detona-

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tion signal, so there is a lack of motivation in the art to apply the teachings disclosed by the Driscoll reference to detonating cord. Furthermore, even if such a motivation were found, and there is no reasonable expectation of success of attaining the effect disclosed by Driscoll in the detonating cord of Jones, due to the fundamental difference between burning reactions and detonation reactions.

To reliably incorporate the teaching of the Driscoll reference concerning the use of microballoons with the Jones reference, the explosive core of Jones' detonating cord would have to be replaced with a material that would burn rather than detonate. This would amount to a fundamentally different mode of operation. Since an obviousness rejection cannot be based on an asserted combination that requires a change in the mode of operation of one of the references (see MPEP 2143.01), the asserted combination lacks a proper basis in law.

Finally, the motive for the asserted combination, to reduce the sensitivity of detonating cord, has no relevance to the present invention, since the Applicants discovered that microballoons have an unexpected effect on explosive material in detonating cord: a reduction in the velocity of detonation.

The foregoing remarks should make it clear that the stated rejection of the captioned claims is based on a misinterpretation of the Driscoll reference, and that when properly read, the teachings of the Driscoll reference have no relevance to the Jones reference, the applied references fail to provide any motivation to combine their teachings, and even if such a motivation were found, the combination would either require a fundamental change in the mode of operation of one of the references or would lack a reasonable expectation of success. For each of the foregoing reasons, the stated ground of rejection is respectfully traversed.

II. Rejection of Claims 4, 6, and 7 Under 35 U.S.C. 103

Claims 4, 6, and 7 stand rejected under 35 U.S.C. 103 as being unpatentable over the Jones reference in view of the Driscoll reference and further in view of the Takeuchi et al. reference.

The rejected claims are allowable at least because they depend from a base claim that is allowable for reasons set forth above (section G). Furthermore, the teaching of the Takeuchi et al. reference relates to the use of microballoons in explosives, but provides no

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suggestion or motive for using microballoons in deflagrating ignition materials (the Driscoll reference) or for expecting that microballoons would function the same way in both kinds of materials. Furthermore, as noted above (section E), the Takeuchi et al. reference teaches away from using quantities of microballoons that reduce detonation velocity, and so teach away from the invention. Since the combined teachings of the art militate away from these claims, they should be viewed as presenting an additional basis of patentability independent of the patentability of claim 3. Accordingly, the stated ground of rejection is respectfully traversed.


I. Amendment to the Specification

The amendment to paragraph [0052] brings the amended application text into conformity with the preceding text and the data to which the amended language refers. Accordingly, the amendment does not introduce new matter.

Each of the stated grounds of rejection have been addressed or traversed. Reexamination and reconsideration of the pending claims, and reinstatement of the claims withdrawn from consideration, are respectfully requested.

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